Rhodora

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THE NEW ENGLAND BOTANICAL CLUB

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INSECTICIDES USED AT THE GRAY HERBARIUM.

B. L. Robinson.

One of the questions most frequently asked by visitors at the Gray Herbarium is what means are employed to prevent the insect depredations to which all large collections of plants are to a greater or less extent exposed. This interest in the matter leads to the belief that it may be worth while to record the methods, which have been adopted, after a varied experience of many years, in dealing with this problem.

Until about 1885 it was the custom to poison with corrosive sublimate all specimens placed in the organized part of the Gray Herbarium. This was done in two ways. The first and crudest was to paint the specimens, after mounting, with an alcoholic solution of the sublimate, much to the disfigurement of the sheets. This way was soon abandoned as a general method and only resorted to in cases in which it was found that a sheet, already mounted, was infested by insects. The second method, used for many years, was to dip each dried plant, before mounting, into a shallow tray of the same solution and then dry it between blotters. This mode of procedure is, with various modifications, the one now followed in many private herbaria and in several of the great European collections. There is no doubt that it has a certain efficiency, but it also has considerable disadvantages. The slowness and expense of the treatment, while not burdensome in collections of moderate extent, become much more serious when the number of specimens mounts to many thousands annually. However, these are not the chief drawbacks. There is the difficulty of keeping an alcoholic solution at such a point of

density that it will be most effective and yet not deposit a perceptible coating of the sublimate upon the plant and thus alter the appearance of the surface, so that it loses to a certain extent its natural condition, so important in the identification of plants. In extreme cases it has been found that such a coating of sublimate may render it difficult to tell whether or not a given stem was glaucous in nature, or to determine with a hand lens the precise amount and character of minute pubescence. If, on the other hand, the density of the solution is allowed to sink much below saturation, a question arises whether the treatment is really effective. Many plants even in the dried state retain enough of their waxy super-cuticular coating to make it doubtful how thoroughly their tissues are reached by the solution during the brief wetting usually practiced. In this regard, however, it is to be admitted that an alcoholic solution would certainly be much more penetrating than an aqueous one.

There is an additional difficulty in this mode of poisoning from the fact that many dried plants, such as Potamogetons, aquatic Ranunculi, and others of delicate texture, quickly curl or become hopelessly tangled during an attempt to dip them into a solution of any kind. Other plants have a chlorophyll so delicate and tissues so easily penetrated by an alcoholic solution that they emerge from even a very short bath in a spotted and disfigured condition, the alcohol having partially exercised its well known solvent action upon the green coloring matter.

To prevent the curling of the specimens while they are drying after their bath, it is necessary, as already stated, to put them between driers, and these blotters draw off the greater part of the solution which the plants have taken up. Herein lies one of the chief reasons why the treatment is not more efficient, for it is probable that such parts of waxy-coated stems and leaves, as come into direct contact with the blotters, lose practically all the solution which may have adhered to them. Such exposed parts must become, especially after further cleansing, as for example through the friction of a towel during the process of mounting and the ordinary rubbing of superimposed sheets in the herbarium, vulnerable points for the attacks of the herbarium beetle. To overcome this difficulty, in some of the foreign herbaria, some more viscid substances and a small quantity of carbolic acid are added to the alcoholic solution of corrosive sublimate, rendering it more adhesive. However, this sort of perma-

nent more or less shellac-like coating over the specimens, even when very thin, affects the appearance of the surface.

A final annoyance in connection with the sublimate treatment arises from the circumstance that the substance is a violent poison to human beings as well as to insects. I am not aware that any case is on record of a person having been injured or even greatly annoyed by the use of corrosive sublimate in connection with an herbarium, although a physician once told me that he had experienced some irritation of the eyes while poisoning plants in this manner. However, although the danger to the amateur, whose herbarium work is confined to scattered hours of leisure, may be so slight as to be negligible, the question becomes more serious in a great herbarium in which an assistant would have to be engaged more or less continuously in such employment. The fact that corrosive sublimate is not a volatile substance doubtless much diminishes the danger, but in this connection it is to be remembered that during the changing of the driers and mounting of the plants subsequent to the dipping, many minute particles from the plants and driers are necessarily detached, forming a dust saturated with sublimate, which in this way must, to a considerable extent be inhaled by a person carrying on the work.

At the Gray Herbarium, however, it was not the difficulty, expense or even the danger (against which some expedients could probably be devised), which led to the abandonment of corrosive sublimate as an insecticide. It was its inefficiency. After many years experience with it Dr. Gray, annoyed by the poor results, declared with conscious hyperbole that the more the sublimate was used, the more insects came, — that they throve and grew fat on it.

About 1885 the sublimate was replaced at the Gray Herbarium by an alcoholic solution of acetate of arsenic. All plants added to the herbarium were dipped in this in the same way as above described for the sublimate solution. The acetate was selected from several salts of arsenic because of its deliquescent character, in consequence of which it was believed that it would be less likely to be detached as dust and render the atmosphere of the herbarium rooms unwholesome. This method was followed until 1890, when it was found on medical examination that two of the assistants, who had been suffering from some unknown irritation and general debility, had absorbed considerable quantities of arsenic, which in one instance had produced a temporary irritation of the kidneys. The

use of arsenic was then promptly given up and happily the physiological effects soon disappeared.

Thoroughly discouraged by the ineffectiveness and danger of the poisons hitherto employed, Dr. Sereno Watson, then in charge of the Herbarium, decided to give up the poisoning entirely, and to trust on the one hand to the tightness of the cases and on the other to the vigilance of the staff to protect the collection from insect depredations. After three or four years, however, it was found that both the small brown "herbarium beetle" (*Sitodrepa panicea*) and a more minute and colorless member of the Psocidae, the "book-louse" (*Atropos divinatoria*)[1] were increasing at an alarming rate and becoming pretty generally distributed in the collection. This was doubtless due in part to the fact that some large herbaria, acquired about that time, notably the collection of the late Dr. George Thurber, were badly infested by insects. In the injury to specimens at this period, it was clear that the recently inserted specimens, which had not received the corrosive sublimate or arsenic treatment, suffered most. This, however, cannot be taken as an unqualified proof of the value of these poisons, for many specimens of older date, known to have been so treated were found to be infested and injured by the insects, and the fact should be borne in mind that the first five years after the preparation of an herbarium specimen, before it reaches the final stage of complete desiccation, is the period when it is most liable to damage by insects.

The tightness of the cases, with the insects already inside, was naturally found to have only a negative value. Some more drastic means had to be found, and accordingly a tin can was devised for the fumigation of the sheets with carbon bisulphide. It was modelled upon a type of case successfully used by Mr. William Brewster in his valuable collection of birds, but was provided with eight shelves for herbarium sheets, of which it would hold about a thousand. The front of the case, which was also of tin, was provided on the edge with a metal phlange turning inward, which fitted into a metal groove in the case. This groove was lined with a convex strip of soft rubber, which being compressed by the phlange of the cover, when the latter was fastened on by ten external clasps, formed an essentially air-tight fitting. At the bottom of the can, under the lowest shelves, two spaces about two inches high were left for the insertion of shal-

[1] For the identification of these insects I am indebted to Mr. Samuel Henshaw.

low dishes of carbon bisulphide. About six or eight ounces of this were employed for each fumigation and the specimens were left in at least thirty-six and usually forty-eight hours. The effects were entirely satisfactory, so far as sure death to the insects was concerned; but it was soon found necessary to increase greatly the capacity of the apparatus, and four other cans, each capable of holding about two thousand sheets of specimens were installed. These were constructed upon the same plan, but the shallow pigeon-holes for the insertion of the sulphide were arranged at the top instead of the bottom, on the theory that the vapor of carbon bisulphide, being somewhat heavier than air would diffuse more effectively downward than upward. In regard to this point, it may be said that diffusion, although of unequal rate would doubtless occur effectively in both directions, and that theoretically it would be best to insert the sulphide somewhere about a fourth of the distance from the top to the bottom.

Working with the apparatus above described the staff of the herbarium fumigated the entire organized collection and the stored bundles of unworked specimens. Although the mere manual labor of the undertaking was considerable, the results were very repaying. For some months the herbarium was, so far as could be ascertained, entirely free from insects. After a year or so, a rare and sporadic reappearance of the herbarium beetle, led to a refumigation of considerable portions of the collection. Although since the use of the carbon bisulphide method, the number and depredations of the herbarium insects has certainly been reduced by 95 %, it has been thought best to employ in conjunction with this treatment some other precautions. An entomologist who was consulted said that the book-louse could be successfully kept out of any case by the use of camphor, naphthalin or, in fact, any agent producing a strong odor. In accordance with this suggestion flake naphthalin was purchased in large quantity and liberally sprinkled in each pigeon-hole of the herbarium cases. This was done immediately after the cases had been carefully cleaned while the specimens had been removed for their treatment with carbon bisulphide, the naphthalin being left in the cases when the herbarium specimens were replaced on the shelves. At the outset there was considerable scepticism regarding the value of naphthalin, but there is now good reason to believe that by discouraging a new immigration of insects, it is a useful adjunct to the carbon bisul-

phide treatment, especially in packages which are for any reason to be stored some months without opening.

Early in our battle with insects, it was felt that they would find a particular stronghold in what is known as the "bundle-room", where duplicates, unworked collections, etc., are kept, often for considerable periods, in separate packages. Accordingly, special precautions were taken with this room. All material was removed from it and the floors, standing woodwork and shelves were painted over with a nearly saturated alcoholic solution of corrosive sublimate — a treatment not to be recommended where woodwork is highly finished or its appearance a matter of consequence. This was done with the idea of sterilizing as far as possible any accumulations of organic dust, which might have lodged in the cracks of the woodwork in a manner to form food for insects. The packages were then brought back to this room only after a fumigation of at least forty-eight hours in the vapor of carbon bisulphide. Each package, tied in a preliminary manner, received a handful of flake naphthalin well sprinkled in among its sheets and was then securely wrapped in stout manila paper, tied, tagged, and placed on the sterilized shelves. This was done some years ago and the results have been most satisfactory. In fact, I am not aware that a live insect has been detected in the bundle-room since.

Even after the efficiency of these methods had thus been amply demonstrated, there was much left to be desired. Fumigation with carbon bisulphide is of necessity an annoying process from the extremely disagreeable and penetrating odor; and even if the cans or tanks, in which the fumigation is effected, are kept at a distance from the main rooms of the herbarium, the sheets retain for some days the odor, which is scarcely less disagreeable as it becomes fainter. The farther away the fumigating tanks are kept, the greater the labor of transporting the thousands of packages of herbarium sheets from the cases to the tanks and back again. To avoid the wear and tear upon the specimens, as well as to save much time and trouble, the attempt was made to fumigate the herbarium sheets directly in the wooden cases, where they are kept. This, however, proved a failure. Although about two pounds of the sulphide was used in a tightly closing twenty-six pigeon hole case and fumigation prolonged forty eight hours, it was found that living larvae of the herbarium beetle, which had been previously inserted among sheets in the case, although

apparently dead when taken out, became active again after two or three hours in air and sunshine. It is thus clear that carbon bisulphide fumigation to be effective must be conducted in metal cases.

Partly for this reason and partly with a view to the improvement of the fire precautions at the Gray Herbarium, much thought was devoted to the construction of a case for ordinary use in the herbarium, which should be at once gas-tight and fireproof. These features, which seemed simple enough, proved in combination rather difficult to realize, especially in a case which must open and close readily. After the supposed advantages of an all-metal case and a wooden case covered outside and in with sheet iron had been carefully weighed, sixteen trial cases of the second type were installed about a year ago. The doors, hinged at the side as usual, closed upon a continuous soft rubber buffer to render the fitting as air-tight as possible. These cases have proved satisfactory for purposes of fumigation, although they cannot be regarded as absolutely air-tight, a relatively small quantity of the vapor of the sulphide escaping around the doors. It is believed that they are also as fire-proof as cases can well be made. Unfortunately, however, it has been found impossible to treat the tinned sheet-iron covering in any way which does not make the case a crude and unsightly object. When, during the spring of the present year, it was again necessary to add a block of cases it was decided to have them made entirely of sheet steel, the plates of metal, wherever they came on the outside, being double with an air space of about five eighths of an inch intervening. This feature not only adds, on the well known principle of the hollow column, much strength to the structure as a whole, but is believed to insure practically as great protection against fire as the metal-covered wooden construction. Through the generosity of a liberal but anonymous friend of the Gray Herbarium it has been possible to have a trial block of eight such steel cases manufactured and recently set up in the main working room. They were made by the Art Metal Construction Company of Jamestown, New York, and the Gray Herbarium is much indebted to Messrs. Hine and Sullivan, the Boston representatives of the company, for their painstaking attention to this new application of their methods in steel work. In these cases, as in many safes, the doors fit with pressure against a smooth strip of piano felt, making a junction which is probably quite as effective as the rubber buffer above mentioned. The cases are handsomely japanned in light gray, are

provided with very firm and easy working latches, securing the door in three places at once, and are believed to represent an ideal herbarium case, so far as the subject is at present understood.

Since the instalment of the metal-covered and all-metal cases, much fumigation has been carried on in them. Of course, the great quantity of carbon bisulphide, which it is necessary to employ in cases of this size (twenty-six six-inch pigeon holes each)[1] would render any room disagreeable, and it is found desirable to carry on the fumigation during the summer vacation when students are away and the regular staff reduced to a minimum. However, if the ideal time ever comes when the whole of the great collection can be thus enclosed in metal, only rare fumigations will be necessary and these can be accomplished with the least possible difficulty.

The use of rubber buffers in closing a can employed for carbon bisulphide fumigation may be a surprise to those who recollect that this agent is a solvent for rubber. Experience, however, shows that the *vapor* of the sulphide exercises no appreciable injury to the rubber, which remains soft and pliant for a longer time than would be supposed.

The odor of carbon bisulphide, notwithstanding all the precautions which could be employed, being a great annoyance, experiments were undertaken with formaldehyde. In these Professor Charles Harrington of the Harvard Medical School, well known as an expert on the subject of disinfectants, was consulted and obligingly gave counsel and aid. The fumigation was carried on in one of the tin tanks with a capacity of about fifteen cubic feet, provided with a tin door closing against a soft rubber strip, thus essentially air-tight. The formaldehyde was produced first by the incomplete combustion of wood alcohol, then, in subsequent experiments, by volatilizing with an alcohol lamp the well known pastilles commonly used in disinfecting. The quantity of vapor produced in each manner was far in excess of the amount which experiment has shown ample to destroy disease germs. Owing to the successful work of the carbon bisulphide method, which had been in use many months, it was found impossible to obtain in the Gray Herbarium any living specimens of the "herbarium beetle" on which to try the effects of the formaldehyde fumigation, and *aphides* from the greenhouses were used instead. The surprising result was

[1] About two pounds in each case.

obtained that these soft, sluggish, and supposably non-resistent creatures came out of a formaldehyde fumigation of many hours duration without any apparent injury, although the same treatment is known to kill with certainty the bacterial germs of anthrax, diphtheria, etc. From these experiments, it was inferred that, however valuable as a disinfectant, formaldehyde would be likely to prove an unsatisfactory insecticide, and further experimentation with it was accordingly abandoned. Others, by varying the method, may have greater success with it.

In using carbon bisulphide, it should always be borne in mind that it is one of the most inflammable liquids known and that its vapor forms highly explosive mixtures with air. It is accordingly of the utmost importance for safety to keep both the liquid and vapor far from fire in any form or indeed from any source of heat, instances being on record in which carbon bisulphide has been ignited by the heat of steam pipes. It goes without saying that no match should be struck, lamp burned, or fire used in any manner in a room in which the fumigation is being conducted. The possibility of this easily inflammable agent acting chemically upon other substances employed in herbarium work and causing a heat-producing reaction sufficient to produce ignition, was early considered at the Gray Herbarium, and expert chemical advice sought. Happily, no such reaction appears possible with the other substances used. Where carbon bisulphide is to be used in quantity, it is a desirable precaution to store it in a remote out-building, bringing to the herbarium from time to time only such amounts as are to be used at once. The sulphide employed at the Gray Herbarium is kept in a small tool-shed at the back of the Botanic Garden. Some years ago it was kept in an old shed under a disused water tank, but one day the whole structure suddenly collapsing freed many pounds of the sulphide, which for some hours threatened an unwelcome fumigation to the entire neighborhood.

At the Gray Herbarium it has been found that no large group of vascular plants seems entirely immune from the attacks of insects. Probably the sedges are as little in danger as any; grasses and ferns also, if kept in perfectly dry cases are little subject to such injury, although one of the worst cases of insect work which has come to attention was on a collection of ferns stored for some years in Trinidad, doubtless in a damp atmosphere. Plants with a milky juice and

saprophytes seem especially attractive to insects. The Leguminosae and herbaceous Liliaceae also form vulnerable spots in an herbarium. In such groups as the Coniferae and Typhaceae, the staminate inflorescence is the chief point of attack.

The "herbarium beetle" is capable of eating almost any part of the plant, and includes lignescent stems and sometimes glue or even portions of the herbarium sheet in its diet. The book-louse, on the other hand, being especially attracted by pasty or saccharine substances, confines its injuries to delicate parts of the flower, chiefly the petals, anthers, and nectaries.[1]

Besides the insects mentioned, there are others peculiar to certain groups of plants, such as the gentians, irises, Peltandra, etc. These creatures, deposited as eggs in the base of the flower during the life of the plant, are apt to cause considerable annoyance by their ravages during and shortly after the drying of the specimen. The expedient of a short bath in steam or boiling water is only partially successful, since it usually results in a discolored or otherwise damaged specimen. How best to combat these most insidious insect enemies is a problem, to which it is hoped some amateur with leisure for experimentation and a taste for the refinements of herbarium technique may turn his attention. Probably the simplest way to avoid the difficulty in the case of the particular plants is to prepare specimens in some quantity and discard those injured while drying.

The burning of sulphur, practiced at some herbaria, to destroy insects, has never been tried at the Gray Herbarium, as it is difficult to feel quite satisfied that the methods ordinarily employed can be applied on a large scale without a slight fire danger. Furthermore, sulphurous acid exercises a strong bleaching action, and would be likely to affect the ink of the labels, even if not the plants themselves.

While the results of the experiments at the Gray Herbarium force us somewhat reluctantly to the belief that carbon bisulphide fumigation is the most efficient means of preventing insect depredations in herbaria of large size, I would not be taken as discouraging those who are employing corrosive sublimate. Several amateur botanists, with excellently appointed herbaria, ranging from ten to fifty thousand sheets, have told me that they have found the corrosive sublimate bath

[1] The carpet beetle (*Anthrenus varius*) and its larvae are occasionally found among herbarium sheets, but it has not been possible to ascertain whether it does any damage to the plants.

a perfectly satisfactory safeguard. On the other hand, I have recently learned with surprise that carbon bisulphide fumigation has been found ineffective in at least one herbarium of great size. This leads to the conclusion that, whatever method is adopted, success must come largely from care and thoroughness in its application. The danger from insects must be considerably greater in old buildings, and reduced to a minimum in new ones of modern construction with concrete floors and metal shelves. In any case, scrupulous neatness should be maintained in the surroundings of an herbarium. No accumulations of dust should be allowed on tables or shelves; dust-filled cracks in woodwork should be sterilized; all mouldy, imperfectly dried, or otherwise useless material should be promptly removed; and finally special attention should be taken to prevent the insect life in packages of stored duplicates, etc.

As efficient as the carbon bisulphide method has proved, its annoyance and danger are such as to stimulate investigations in other directions and at the suggestion of Professor W. E. Burke of the Engineering Department of Harvard University, some interesting experiments are being undertaken in the use of vacuum as a means of destroying insects. If it can only be demonstrated, that insects cannot survive in ordinary vacuum or, to speak more precisely, in an extremely attenuated atmosphere, much may be hoped from such a substitute for fumigation. Surely no other penetrating fatal agent could combine more happily so many desirable negative traits, such as perfect freedom from odor, poisonous fumes, and bleaching action, as well as from explosive, inflammable, or other qualities likely to render the herbarium rooms disagreeable or dangerous.

Gray Herbarium.

A NEW KOBRESIA IN THE AROOSTOOK VALLEY.

M. L. Fernald.

On June 29, 1899, the Josselyn Botanical Society of Maine spent the forenoon on the south bank of the Aroostook River at Fort Fairfield, Maine; and among other interesting plants collected by them was a slender wiry sedge first noticed by Miss Mabel P. Cook near the little spring above the long bridge over the Aroostook River. At

the time, a few specimens were prepared by the writer and the plant was laid aside for future study. The material was over-mature, with an inclination to shell; but the small oblong fruits were so unlike those of any known Carex of the *Elongatae* (to which group the plant seemed to have affinity) that it was recently described by the writer as a unique species, *Carex elachycarpa*.[1]

Subsequent trips to Fort Fairfield were too early or too late in the season for the local sedge to be found in good condition, until in early July, 1902, Messrs. J. Franklin Collins, Emile F. Williams and the writer spent a week at Fort Fairfield. Among the important objects of the first afternoon's excursion was, naturally, a visit to the original station of *Carex elachycarpa*. There, in the rain, we searched the seepy shore where Miss Cook had first called attention to the plant, and although we crept on hands and knees amongst the abundant *Triglochin palustris*, *Calamagrostis neglecta*, and *Juncus alpinus*, the only plant found resembling the little-known *Carex elachycarpa* was a tall slender and immature state of *Carex interior*. This result was of course most discouraging and it even led us against our own convictions to wonder if, after all, the material from which *Carex elachycarpa* had been described could have been an aberrant state of *Carex interior*. With this unsatisfactory ending of our first afternoon's work we returned to the hotel; but early next morning we visited a similar seepy and sandy spot on the north bank of the river. There almost immediately our discouragement was banished, for, mingled with *Carex interior*, *Triglochin maritima*, and *Juncus balticus*, was the wiry plant with the rigid spikes and characteristic little oblong subterete fruits of *Carex elachycarpa*. Abundant material in various stages of development was secured, and the remainder of the morning devoted to further exploration of the north bank of the river.

In the afternoon while Mr. Williams and the writer were putting up the morning's collection, Mr. Collins amused himself by studying the structure of the rediscovered *Carex elachycarpa*. This diversion, quite innocent in its motive, soon resulted in the investigator asking seriously "Is this a *Carex* after all?" An improvised dissecting microscope was soon constructed by fastening a Coddington lens on the blade of a partially open knife, and a series of dissections of the

[1] Proc. Am. Acad. xxxvii. 492, figs. 133, 134 (1902).

younger material quickly showed that our plant had the flower-structure not of Carex, but of the Himalayan and high-northern genus *Kobresia*.

In *Carex* the ovary is surrounded by an indehiscent closed pouch, the *perigynium* or *utriculus*. In *Kobresia* the ovary is wrapped about by a concave glume which is open on one side or with the margins merely united at the base. In *Carex elachycarpa* the glume has the margins united at the very base, but the mature achene protrudes between the free margins of the glume, and appears strongly exserted. On this account it may easily be mistaken for the perigynium of a Carex and only close examination will reveal its true nature. There is no question, however, that *Carex elachycarpa* has its affinities with Kobresia, a genus which is little known in North America; but like many of the species referred to Kobresia *Carex elachycarpa* is a problematic plant.

Besides the genus Carex the members of the *Cariceae* have been grouped by different modern authors into various ill-defined genera varying with the personal equation from two to five [1] while by early authors most of the better known species have been united with Carex. By Bentham & Hooker [2] four genera — *Kobresia*, *Hemicarex*, *Schoenoxiphium*, and *Uncinia* (besides *Carex*) were recognized, though Kobresia was placed in the *Sclericae*. In his monograph of Hemicarex and its allies, in 1883, Mr. C. B. Clarke recognized [3] the same four genera, although he pointed out that they are based on somewhat artificial characters and that the original "*Kobresia* had the glume of the female flower concave, open or with the margins slightly connected near the base; *Carex* had a complete utricle. But in the considerable number of species now known of *Kobresia* (including

[1] Rafinesque in The Good Book — Number 1, or Amenities of Nature (1840) p. 23–24, says in his discussion of "The natural family of Carexides," "Yet they persist in deeming this vast assemblage a Genus! instead of a family!.... As I possess nearly 240 sp. of this group, American, Siberian and European, and have always deemed it a family, I may at last venture to split it into 22 Genera perfectly distinct"; yet it is surely disconcerting to present-day students of Carex to find that in the "perfectly distinct" genera of Rafinesque *Carex cephalophora* appeared as a "type" of both *Carex* and *Diemisa*; *C. crinita* as a "type" of both *Diemisa* and *Neskiza*; *C. lacustris* of both *Carex* and *Anithista*; *C. oligocarpa* of *Olotrema* and *Deweya* "(or *Meltrema* if Dewey has a G[enus].)"; and *C. pubescens* of *Enditria* and *Diemisa*. The excessively artificial nature of Rafinesque's genera is further shown when we find *Carex flava*, *Oederi*, and *viridula* (now often considered one species) as types of three "perfectly distinct" genera.

[2] Gen. Pl. iii. 1071, 1072.

[3] Journ. Linn. Soc. xx. 374.

Hemicarex, Benth.), this character is found to become illusory by degrees: the margins of the glume are exceedingly thin and brought close together; whether they are actually connate for more or less than half the length of the glume appears a matter of very slight importance to establish a genus upon, and from the exceeding fragility of the scarious margins it is exceedingly difficult to determine; different female flowers from the same plant, treated with every care under water, give different results."

In 1887 Pax essentially followed [1] Clarke's treatment, but separated *Elyna* from the *Kobresia* of Clarke. But in 1894 Clarke united [2] *Kobresia*, *Elyna* and *Hemicarex*, a course which seems far more satisfactory than the earlier one of separating them generically on illusory characters. In this treatment Clarke recognized 20 species of *Kobresia*: 13 confined to the Himalaya of northern India, occurring mostly at altitudes of 10,000 to 16,000 feet from Kashmir to Bhutan; 2 crossing the Himalaya from India to western Tibet; 1 in the Himalaya of northern India and western Tibet, and the Hindukush Range of Afghanistan; 1 extending from Tibet to Transbaikalia (Dahuria of Pallas); 1 from the Himalaya of northern India and western Tibet to Siberia and the Caucasus; and 2 of general arctic distribution, extending south in the north temperate regions to the Altai, Caucasus, Alps, and Pyrenees, and in the Rocky Mountains to Colorado.

Of the 20 known species of *Kobresia*, 19 have 3-cleft styles and trigonous achenes, and usually (if not always) male flowers with 3 stamens. In a single Tibetan species, *K. macrantha*, Boeckeler, the style is 2-cleft and the achene flat, not trigonous; and for this species differing from all others in these two characters Mr. Clarke has proposed the sectional name *Pseudokobresia*.

It is of great interest, therefore, to find in studying *Carex elachycarpa* of the Aroostook Valley that while it has the general floral structure of most Kobresias it has only 2 stamens and 2 style-branches instead of 3, and a compressed subterete, instead of trigonous, achene. Thus the Aroostook Valley plant most closely approaches in its characters the unique *Kobresia macrantha* of central Asia, but from that species it is very clearly distinct in its elongate narrow

[1] Engl. & Prantl, Nat. Pflanzenf. ii. Ab. 2, 121–122.

[2] Hook. f. Fl. Brit. Ind. vi. 694–699.

spike, subterete (only obscurely flattened) small achene, and in the male flowers with only 2 scarcely exserted stamens.

Differing from most other species in its 2-cleft style and from them all in its subterete achene and apparently in its 2 stamens, *Carex elachycarpa* might seem worthy generic separation from the essentially Himalayan *Kobresia*. But in view of the occurrence in *Carex* of either 2 or 3 style-branches and of either trigonous, subterete or strongly compressed achenes; in *Eleocharis* of terete or trigonous achenes; and especially in view of the subspathiform glume of *Carex elachycarpa* the plant is best treated as a unique *Kobresia*; and its discovery in northern New England suggests that further exploration may show that this remarkable genus is more generally represented in America than has been supposed.

From our more complete knowledge of the Aroostook River plant and its affinities it should be redescribed as

Kobresia **elachycarpa**. Densely tufted; the wiry compressed culms 2 to 5.5 dm. high, scabrous above; leaves flat (1 to 2 mm. wide), rather stiff, ascending, about half as long as the culms; spikes 1 to 2.5 cm. long, of 2 to 7 mostly remote appressed-ascending spikelets; spikelets either staminate (clavate), androgynous (staminate above, with 1 to several pistillate flowers below), or pistillate throughout (ovoid); bracteole (corresponding to the "scale" of *Carex*) ovate, concave; glume (corresponding to the "perigynium" of *Carex*) ovate, subspathiform, connate at base, emarginate at tip, more or less marked with green and brown: style with 2 long branches, the elongate base becoming chartaceous dark brown and subpersistent, finally separating from the truncate oblong subterete nerveless pale achene (1.2 to 1.5 mm. long): stamens 2, scarcely exserted, the anthers much exceeding the filaments.— *Carex elachycarpa*, Fernald, Proc. Am. Acad. xxxvii. 492, figs. 133, 134 (1902).— Maine, wet sandy banks of Aroostook River, Fort Fairfield, June 29, 1899 (*M. P. Cook*, *E. L. Shaw* & *M. L. Fernald*), July 15, 16, 1902 (*J. F. Collins*, *E. F. Williams* & *M. L. Fernald* in Plantae Exsiccatae Grayanae no. 115).

Gray Herbarium.

NOTES ON NEW ENGLAND DESMIDS,—II.

Joseph A. Cushman.

The Desmids reported here are from two different localities. One collection was made from a small pond on Misery Island, off Beverly Farms, Massachusetts, by the writer; the other from Kittery, Maine, by Dr. Roland Thaxter. Both contain species not hitherto definitely reported from New England and each includes species new to the state in which the collection was made. The specimens reported are in the herbarium of the writer, and they are indicated as H. C. no. 400, etc. The collection from Misery Island was from a small pond which at first glance would seem to be salt or at least brackish, but tides do not appear to reach the pond for it is fresh and contains fresh-water algae, among them many Desmids. It was thought at first that no filamentous forms were present, but a species of *Sphaerozosma* has turned up; curiously enough a species not before reported from New England. The assemblage of species is in many ways a curious one. Except where they have been reported from several localities in different states and are thus already known to have a wide range in New England, the previously reported localities are given. *Docidium* and *Penium* two of the common genera seem to be wanting. The following species were identified in the collection:

1. *Sphaerozosma spinulosum* Delp., var. Diam. 10 μ. A little wider than long, granules and not spines; otherwise like Delponte's species; more often two granules than three on each margin. In each semi-cell is a projection not shown in Wolle's figure of the species. Not common. *New to New England.* (Herbarium of J. A. Cushman, no. 376.)

2. *Closterium Jenneri* Ralfs. Diam. 15 μ, length across tips 70 μ. Rare. (H. C. no. 382.)

3. *Closterium lineatum* Ehrb. Diam. 50 μ, length across tips 80 μ. Not rare. (H. C. no. 337.)

4. *Closterium Lunula* Ehrb. Diam. 95 μ, length 540 μ. Seems to be rare. (H. C. no. 370.)

5. *Closterium subtile* Bréb. Diam. 6–7 μ, length 218 μ. The diameter is greater than that given by Wolle, but the plant otherwise fits the description and figures of the species. Reported before only from Orono, Maine. Rare. *New to Massachusetts.* (H. C. no. 382.)

6. *Cosmarium Bœckei* Wille. Diam. 28 μ, length 31 μ, isthmus 9.5 μ. The granules both in position and number are like the figure given by Wille. Frequent. Reported previously only from Orono, Maine. *New to Massachusetts.* (H. C. no. 379.)

7. *Cosmarium Botrytis* Menegh. Diam. 60 μ, length 71 μ, isth. 17 μ. Very abundant and varies considerably. (H. C. no. 400.) Zygospores present — measuring with spines 80 μ, without 62 μ. (H. C. no. 382.)

8. *Cosmarium intermedium* Delp. Diam. 40 μ, length 56 μ, isth. 12.5 μ. Occasional. *New to New England.* (H. C. no. 379.)

9. *Cosmarium laeve* Rab., var. *septentrionale* Wille. Diam. 18 μ, length 28 μ, isth. 6 μ. Like Pl. xliii, f. 14, Wolle 1892. Slightly larger than the measurements given there. Common. (H. C. no. 394.)

10. *Cosmarium protractum* (Naeg.) Arch. Diam. 30 μ, length 34 μ, isth. 9 μ. This form corresponds to that of Pl. xx, f. 29, Wolle. 1892, given as *Cosmarium ornatum*, var. *minor.* Reported previously from Orono, Maine. *New to Massachusetts.* Common. (H. C. no. 394, 387, etc.)

11. *Cosmarium punctulatum* Bréb. Diam. 28 μ, length 31 μ, isth. 10 μ. Very common. (H. C. no. 400.)

12. *Cosmarium Quasillus* Lund. Diam. 58 μ, length 68 μ, isth. 14 μ. Ends somewhat concave. Reported previously from Orono, Maine. *New to Massachusetts.* (H. C. no. 376.)

13. *Euastrum verrucosum* (Ehrb.) Ralfs. Diam. 68 μ, length 80 μ, isth. 16 μ. The typical form. Occasional. (H. C. no. 382.)

14. *Micrasterias Americana* Ralfs. Diam. 100 μ, length 125 μ, isth. 28 μ, diam. bas. pol. lobe 28 μ. Like the figure of *M. Americana* Ralfs, forma *genuina* Ralfs given by Maskell except that the two spines on the polar lobes are sometimes lacking. Frequent. (H. C. no. 346.)

15. *Micrasterias Americana* Ralfs, var. This differs from any of the reported varieties and will be reported at a future time. (H. C. no. 343.)

16. *Staurastrum dejectum* Bréb, var. *mucronatum* Ralfs. Diam. 21 μ, length 18 μ, isth. 5 μ. Small form. Reported previously from Steep Brook, Massachusetts. Occasional. (H. C. no. 387.)

17. *Staurastrum echinatum* Bréb. Diam. 40. μ, length 42 μ. More aculei than noted by Wolle, about one third larger, otherwise similar. Occasional. (H. C. no. 387.)

18. *Staurastrum muticum* Bréb., var. *minus* Wolle. Diam. 21 μ, length 24 μ, isth. 6.5 μ. Occasional. (H. C. no. 376.)

19. *Staurastrum punctulatum* Bréb. Diam. 30 μ, length 30 μ, isth. 12 μ. Usually joined in a series of two or more, often four. Common. (H. C. no. 394.)

20. *Staurastrum subarcuatum* Wolle. Diam. 25 μ without the spines. Common. Previously reported from Steep Brook, Massachusetts. (H. C. no. 347.)

The collection made by Dr. Thaxter at Kittery, Maine, contained the following species:

1. *Hyalotheca dissiliens* (Smith) Bréb. Diam. 22 μ. Very common, much of it in a fruiting condition. (H. C. no. 386.)

2. *Hyalotheca dissiliens* (Smith) Bréb., var. *hians* Wolle. Diam. 31 μ, diam. of mucous sheath 70 μ. Not so common as the typical species but not infrequent. It has been reported but once from New England, then from Amherst, Massachusetts. *New to Maine.* (H. C. no. 386.)

3. *Hyalotheca mucosa* (Mert.) Ralfs. Diam. 19 μ. Not infrequent *New to Maine.* (H. C. no. 371.)

4. *Bambusina Brebissonii* Kg. Diam. including projections 22 μ, average length of cells 25 μ. Scarce. (H. C. no. 342.)

5. *Desmidium aptogonium* Bréb. This species was noticed in looking over fresh material.

6. *Desmidium Baileyi* Ralfs. Diam. 27 μ, length 22 μ, av. diam. of excavation 9 μ, av. length of same 19 μ. Frequent. (H. C. no. 344.)

7. *Desmidium cylindricum* Grev. Diam. 36–46 μ, sheath 63 μ. Common. (H. C. no. 390.)

8. *Desmidium Swartzii* Ag. Diam. 42 μ. Large form. (H. C. no. 371.) Another measured diam. 36 μ. (H. C. no. 390.) Common.

9. *Arthrodesmus Incus* (Ehrb.) Hass. This species was noticed in looking over fresh material. *New to Maine.*

10. *Penium Digitus* (Ehrb.) Bréb. Diam. 48 μ, length 164 μ. Somewhat smaller than the measurements given by Wolle. Frequent. (H. C. no. 386.)

11. *Penium margaritaceum* Bréb. Diam. 36 μ, length 220 μ. A more compact form than that given by Wolle as a comparison of the measurements will show. Not common. (H. C. no. 342.)

12. *Closterium acuminatum* Kg. Diam. 25 μ, length across ends 190 μ. Frequent. Reported from Bridgewater, Massachusetts. *New to Maine.* (H. C. no. 391.)

13. *Closterium Ensis* Delp. Diam. 42 μ, length 550 μ. The diam. of this specimen exceeds that given by Wolle. Not infrequent. *New to New England* (H. C. no. 344.)

14. *Closterium juncidum* Ralfs. This species was noted among the fresh material with excellent zygospores.

15. *Closterium striolatum* Ehrb., var. *intermedium* Ralfs. Diam. 56 μ, length 490 μ. About 24 striae in all, distant. Frequent. *The variety is new to New England.* (H. C. no 371.)

16. *Closterium Venus* Kg. Diam. 10 μ, length across ends 48 μ. Frequent. (H. C. no. 384.)

17. *Docidium Trabecula* (Ehrb.) Naeg. Diam. at middle 28 μ, at end 16 μ, length 440 μ. Common. (H. C. no. 480.)

18. *Calocylindrus connatus* (Bréb.) Kirch. Diam. 63–65 μ, length 83–87 μ, isth. 45–50 μ. The isthmus seems to be slightly narrower than in the figures given by Wolle. Common. (H. C. nos. 389 & 381.)

19. *Cosmarium Broomei* Thwaites. Diam. 32 μ, length 34 μ, isth. 12 μ. Frequent. (H. C. no. 377.)

20. *Cosmarium capense* Nordst. The specimen compares well with the figure given by W. & G. S. West (Jour. Linn. Soc. Lond. Bot. xxxiii, p. 301, Pl. 17, f. 3.) Rare. *New to New England.* (H. C. no. 480.)

21. *Cosmarium laeve* Rab., var. *septentrionale* Wille. Diam. 21 μ, length 27 μ. Common. *New to Maine.* (H. C. no. 377.)

22. *Cosmarium nitidulum* DeNot. Diam. 42 μ, length 50 μ, isth. 15 μ. Like the figure and description but considerably larger than the measurements given by Wolle. Rare. *New to Maine.* (H. C. no. 372.)

23. *Cosmarium Portianum* Archer. Diam. 25 μ, length 36 μ, isth. 9 μ. Reported but once before from New England, then also from Maine. Rare. (H. C. no. 377.)

24. *Euastrum* sp.? Two species of this genus were found but are not yet identified.

25. *Staurastrum muticum* Bréb., var. *minus* Wolle. Frequent. (H. C. no. 347.)

TWO PLANTS NEW TO THE FLORA OF LYNN, MASSACHUSETTS.

L. A. Wentworth.

It is a pleasure to call attention to two plants of considerable interest, which do not appear ever to have been recorded as occurring in this vicinity. The first of these is *Geranium pratense* L., a European species, already reported as well established in Maine. It occurs in a healthy and growing colony in a meadow at Swampscott, Massachusetts, and presents a pretty sight in the flowering season. In the size of its flowers and in its general habit it is not very unlike our native *G. maculatum*, L., but the leaves are cleft into narrower segments.

Centaurea solstitialis, L., seems more of a curiosity than the foregoing plant on account of its curious involucral spines and bright yellow florets, the latter feature being quite an oddity among our local members of the *Cynareae*, which, with few exceptions, bear purple flowers. The plant was first discovered in August, 1902, at Lynn, but its blossoming season here begins early in July, according to observations made this year. The plant is easily distinguished, not only by its well marked involucre but by its broadly winged stems, which are thickly covered with a cottony down and branch in an exceedingly sprawling manner; the lower leaves are also quite distinct in outline and remind one of the foliage of the Lactucas. The species seems not to have been reported from America before. It is a native of the Mediterranean region, although it is said to occur in Central Europe as a fugitive weed in cultivated ground. It is one of several species of this attractive although pernicious genus, which have rather recently made their appearance in New England.[1] As the group is very large in the Old World, still others may be expected.

Specimens of Geranium and Centaurea, above discussed, have been deposited in the Gray Herbarium of Harvard University.

While *Potentilla tridentata*, L., is a plant so frequent to the north-

[1] *Centaurea solstitialis*, L., has been found as a ballast weed in the vicinity of New York City; see Bull. Torr. Bot. Club. vi; 257, & xii, 39. It is also said to occur occasionally in the southern United States and in California; see, for instance, Hilgard, Gard. & For. iv. 424 (1891).

ward that it can scarcely pass as a particular rarity, still it is so local in Massachusetts that it is worth while to mention a station at Hamilton, observed July 4th. The plant is growing there in a little community of several hundred individuals, but I have found no trace of the species elsewhere in the vicinity, although it is frequent about Gloucester.

LYNN, MASSACHUSETTS.

A NEW STATION FOR ASPLENIUM EBENEUM HORTONAE.— Miss K. A. French has the honor of discovering a new station for the beautiful plumose variety of *Asplenium ebeneum* called *Hortonae*, which was fully described by Mr. Davenport in RHODORA, iii. 1–2, pl. 22, 1901.

The discovery of this interesting fern specimen in Pittsford (Vt.) July, 1903, swells the fern-list of a section already noteworthy for the choicest species which the fern-flora of the Eastern States can offer.

A study of environment only deepens the mystery of the origin of this remarkable variation. Old fronds about the base testify to the strength and age of the plant, the season's growth out of doors and the newer fronds, which have started up since the plant has been cultivated indoors, are all incised and frilled alike.

Not another plant of this kind was to be found in the locality, although this one was found in the midst of an abundance of the typical *Asplenium ebeneum*.

The overhanging ledge was lavishly decorated with *Woodsia Ilvensis* with a bit of *Polypodium vulgare* here and there. No other Aspleniums were in the near vicinity except a few specimens of *A. Trichomanes* lower down the hill.

All the fronds of the *A. ebeneum Hortonae*, both old and new, are thus far sterile. — G. A. WOOLSON, Pittsford, Vermont.

A NEW ENGLAND STATION FOR BUXBAUMIA INDUSIATA BRIDEL.— While botanizing on a mountain in Surry, New Hampshire, September 3, 1902, I noticed a large decayed log upon which were growing hundreds of peculiar little plants that I at once recognized as Buxbaumias. Several smaller pieces of decayed wood in the vicinity, presumably portions of the same tree, were also covered with the strange-looking objects. I had never before seen them growing, and

supposing them to be the immature capsules of the fairly common *B. aphylla*, only about fifty specimens were collected. I remembered having at my home in New Haven, Connecticut, a reprint of an article by Professor E. J. Durand, on *Buxbaumia* from the Bulletin of the Torrey Botanical Club. On my return a few days later, I was surprised and delighted to find that his description of the rare *B. indusiata* was the one which fitted my plants. Material was submitted to Mrs. E. G. Britton of New York for verification. So far as I am able to learn, this is the first time that the species has been collected in New England.

The stations given by Professor Durand are: — Catskill mountains, New York, 1869 (*C. H. Peck*); Seattle, Washington, 1889 (*C. V. Piper*); Traille river basin, Idaho, 1889 (*J. B. Leiberg*); and Enfield, New York, 1893 (*E. J. Durand*).

The Surry station was again visited in August, 1903, but although the log was identified after a thorough search, it had only a very few green capsules. Many dry capsules were present, the remains of last year's crop. Though *B. indusiata* is said to occur usually on decayed coniferous logs, a few undecayed knots and portions of the trunk proved this to be a poplar log, probably *P. tremuloides*, which grows abundantly in the vicinity. Specimens of this rare moss from Surry have been placed in the collections of Professor W. G. Farlow, Harvard University; Mr. J. F. Collins, Brown University; and in the Eaton Herbarium of Yale University.— B. Madeline Britton, New Haven, Connecticut.

Galinsoga in Maine. — On September 29, 1902, when in Andover, Maine, I was asked by a friend to look at a weed that was becoming very abundant in his garden. It proved to be *Galinsoga parviflora*, Cav., var. *hispida* DC., and was well established in both cultivated and waste ground. During the past summer on July 24th and other subsequent dates I found this plant also at Seal Harbor (Mount Desert), Maine. It was there growing in abandoned garden-plots to the practical exclusion of other weeds. These two stations I think, may be noteworthy as extensions of range. — Edward L. Rand, Boston.

A LEAFLET OF THE SEAL HARBOR VILLAGE IMPROVEMENT SOCIETY.

[It is well known that in the neighborhood of our summer resorts, many of our native plants are becoming less abundant every year, and some of them are in great danger of extermination. The number of plants gathered by plant lovers for various purposes is far greater than one would suppose. A year ago it was suggested to the Village Improvement Society at Seal Harbor, Maine, that something might be done to check unnecessary and careless gathering of the native plants in that part of Mount Desert Island. In consequence of this suggestion a committee was appointed to consider the matter. As one result of this action a circular was prepared by two members of the committee, Prof. Samuel F. Clarke and Mrs. Frances Theodora Parsons, which was widely distributed through the village. So many instances have been observed in which the recommendations of this circular have been adopted by the summer visitors that it seems well to give it a still wider circulation. It is therefore reprinted below with only a few unimportant omissions relating to local plants.—Ed.]

It is to the interest of every visitor to Mount Desert that its beautiful and characteristic plants be guarded from extermination. It is believed that everyone will be ready to aid in this work if once he, or she, fully realizes the danger with which these plants are now threatened.

It is not our wish to discourage unnecessarily the gathering of wild flowers and ferns for decorative purposes. We ask only that they be picked with care and discrimination. Such a flower, for example, as the blue-bell, which forms so beautiful a feature on the rocks along the shore, should always be cut with the scissors or a knife, rather than picked, to prevent its being uprooted, and even when cut, care should be taken to gather it only where it grows most abundantly, that no picturesque tuft be so completely done away with as to set no seeds for another year.

Where there is an especially fine plant or colony, or where there is a single plant or small colony, why not leave at least half the flowers for seed, in the one case giving nature a chance to perpetuate and develop the best, and in the other, helping nature to extend her work of beautifying our surroundings?

The pink lady-slipper, or moccasin flower, the purple fringed orchid, the Calopogon, Pogonia, and indeed all the orchids, should be cut (not picked) fairly high up the stem, leaving, whenever possible the lower leaves intact.

If these flowers are not to be exterminated they should not be gathered at all unless found growing very abundantly, and then only

in moderation. Such fragile blossoms are more effective if not heavily massed, but arranged a few sprays by themselves.

From the purchase of the rarer flowers, especially of the purple-fringed orchid, by the roadside, we urge everyone to abstain. The country children who offer them for sale, are, innocently enough, the most dangerous enemies of all rare, salable flowers.

Ferns, also, should be picked with care, and not too freely, unless in spots where they are unusually abundant. The same caution should be used against breaking branches from shrubs and trees in so rude a fashion as not only to cause a temporary disfigurement, but perhaps a permanent injury.

The hobble-bush, whose effective leaves and brilliant berries decorate gaily the woods of late summer is frequently a victim to careless picking.

The flowers growing in the immediate neighborhood of the roadside are a joy to the many. Is it too much to ask that these be left to delight the eyes of the passer-by, and that the flowers desired for decorative purposes be sought a few feet from the highway, or even from the trail? These roadside plants are constantly enjoyed by those who, by reason of age or some infirmity, could otherwise never see them. Were this once realized few would hesitate to take the trouble entailed by half a dozen extra steps.

We should not fail to add that many of the most effective flowers may be gathered away from the wayside without fear of doing any permanent injury. Daisies, buttercups, clover, wild roses, meadow-sweet, steeple-bush, asters, golden-rod, and other vigorous and abundantly growing plants will yield ample material for decoration and may be gathered almost with impunity.

To sum up we urge:

1st. Moderation. (Not gathering too many flowers of the same kind in one locality.)

2nd. Care. (The use of scissors or knife.)

3rd. Judgment. (Guarding the roadside and conspicuous locations.)

4th. Occasional total abstinence. (In case of especially rare flowers.)

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